The adaption to online synchronous teaching and voice fatigue: acoustic and clinical data

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Abstract

Due to the COVID-19 pandemic, all educators has faced an unprecedented challenge to their professional skills and wellbeing. [1, 6] In 2020 teachers around the world had to shift to online teaching. In 2021 we presented research on the impact of this new professional reality on the vocal load of Saint Petersburg university professors. The online synchronous teaching caused the significant increase in the focal fatigue in university professors in comparison with the pre-pandemic studies. [6] We continued our study during the post-pandemic semester (winter-spring 2022). The goal of this study was to find out whether adaptation mechanisms during the pandemic period were developed to adjust to the different types of teaching mode. The acoustic and clinical data are presented.

Keywords: vocal fatigue, teacher's voice, voice load. online synchronous teaching, COVID-19 pandemic

Introduction

Vocal fatigue in voice professionals has been studied intensely for decades, especially regarding symptoms and risk factors. It is particularly self-reported by teachers as a sense of increased vocal effort and a sensation of laryngeal and pharyngeal constriction. The clinical analysis performed through laryngoscopy can detect symptoms associated with vocal disorders. Besides, vocal fatigue is also shown in tonal range, dynamic range, vocal quality, intensity and fundamental frequency changes. The acoustical aspect of the phenomenon allows its objective evaluating in terms of degree and dynamics.

We performed the acoustic, auditory and clinical analysis of vocal fatigue symptoms in the professors of Saint Petersburg state university (pronunciation teachers and lecturers) in a number of previous studies in the COVID-19 pre-pandemic years. [3-5] Due to the COVID-19 pandemic, there was a dramatic change in the work mode of all voice professionals. In 2020 university professors around the world had to shift to online teaching. In 2021 we presented the research on the impact of this new professional reality on the vocal load of Saint Petersburg university professors. The online synchronous

teaching caused the significant increase in the focal fatigue in university professors in comparison with the pre-pandemic studies.

We continued our study during the post-pandemic semester (winter-spring 2022). During that period our participants either returned to classroom teaching or switched to hybrid mode of teaching (consisting of a mixture of distant and classroom activities). The goal of this study was to find out whether adaptation mechanisms during the pandemic period were developed to adjust to the different types of teaching mode.

Methodology

We followed the protocol used in our **pre-pandemic** and **pandem**ic vocal fatigue studies. All the participants were the professors of Saint Petersburg State University with average work experience of 5 years. The participants were involved in different types of teaching activities: teachers delivering lectures on linguistics; English teachers running practical classes; pronunciation coaches.

The minimum workload a day was 3 hours while the maximum was 6 hours. No one had pathological voice problems. 10 female teachers recorded themselves **before** and **after** classroom/online synchronous teaching using their mobile phones. The participants read a four minute phonetically representative text.

The participants also filled in the self-reporting questionnaire which they had faced in the 2021 study. They graded their physical state, mood and a level of activity at the moment of the recording. We used the **WAM** questionnaire to evaluate psychoemotional state of the teachers before and after their work. **WAM** (wellbeing, activity, mood) is used to assess the mental state of patients and healthy people, their psychoemotional response to loading. [2]

Besides, the participants had the laryngoscopy of vocal cords done regularly during the period of 2021-2022.

Results

Thus we obtained acoustic data (*objective evaluation*), self-reports (*subjective evaluation*) and laryngoscopy results (*clinical evaluation*) which can show the impact of different types of teaching mode on vocal fatigue.

Acoustic data

We calculated a number of acoustic parameters which had been significant for detecting voice fatigue in the previous studies (mean F0, vowel duration and laryngealization) in non-fatigued (NF).and fatigued (F) speech samples The values of these parameters in pre-pandemic, pandemic and post-pandemic recordings are presented in Table1 below.

Table 1. Mean F0, vowel duration increase and the percentage of laryngealized segments in non-fatigued/fatigued speech (pre-pandemic, pandemic and post-pandemic material).

	Pre-pandemic	Pandemic	Post-pandemic
	Mean F0, Hz		
NF	185	178	182
F	188	210	186
	Vowel Duration Increase, ms		
F	4.3	7.2	5.2
	Laryngealization, %		
NF	1.5	1.8	1.4
F	1.2	2.3	1.9

F0 tends to be higher in the fatigued speech across all types of the recordings. However, the post-pandemic values are closer to the pre-pandemic ones. The vowel duration increase in the fatigued speech is still significant, although it has decreased in the post-pandemic period.

Laryngealization which is marked by significant decrease in pitch value and pitch breaks is associated with a creaky voice quality. The symptom was frequently reported by the teachers during the self-assessment of voice quality.

The mean duration of laryngealized speech segments is the longest during the pandemic and has also reduced in the post-pandemic period.

Clinical data

During the extended period of online teaching the clinical picture showed hypotonic dysphonia that was potentially caused by overuse or excess voice use. One of the patients excess voice use during the pandemic period resulted in the pre-nodule condition of vocal cords (pic. 1). The relief in voice fatigue came with both developing adaptation mechanisms and partly switching to in-class teaching in post-pandemic. The picture 2 illustrates certain ease in the condition of vocal tract.

Pic. 1 Pre-nodule condition of vocal cords.   Pic. 2 Hypotonic dysphonia.

Discussion and conclusion

Although the vocal quality improved as well as the clinical picture, but neither the post-pandemic voice nor the laryngoscopic data yet resemble the pre-pandemic condition. The return to the regular working environment (with the absence of the necessity of the microphone use and visible audience follow-up and reaction) has had a positive effect on the vocal functions and reduced possible pathological changes in the larynx.

The analysis of the acoustic and clinical data confirmed the effectiveness of the adaption mechanisms in terms of vocal fatigue decrease. The self-reports showed that during the pandemic period teachers had to develop new strategies to avoid voice overstraining such as slowing the pace, taking frequent pauses, putting an emphasis on diction and consonants rather on increasing the loudness.

References

Besser, A., Lotem S., Zeigler-Hill V. Psychological Stress and Vocal Symptoms Among University Professors in Israel: Implications of the Shift to Online Synchronous Teaching During the COVID-19 Pandemic. Clinics (Sao Paulo). 2021; 76: e2641. Published online 2021 Mar 19. doi: 10.6061/clinics/2021/e2641

Doskin, V. A. Test differentsirovannoy samootsenki funktsional'nogo sostoyania (The Test of Differentiated Self-Assessment of Functional Status)/ Doskin, V.A. Lavrenteva, N.A. Miroshnikov, M.P. Sharay V.B. // Voprosy psikhologii 1973 №6, 141-145.

Evgrafova, Evdokimova, K, V. Acoustic analysis of vocal fatigue in professional voice users. MAVEBA 2011, 153-156.

Evgrafova, K., Evdokimova, V., Skrelin, P., Chukaeva, T. Vocal fatigue in voice professionals: collecting data and acoustic analysis. DOI:10.36505/ExLing-2016/07/0011/000270

Evdokimova, V.V., Evgrafova K.V., Skrelin P.A, Chukaeva, T.V. The database of normal and pathological singers' voices: an approach to collecting data. MAVEBA 2017, 23-24.

Evgrafova, K. V., Sokolova, N. S., Shvalev N. V. The Impact of online teaching during the COVID-19 on vocal fatigue in university professors: self-reports and acoustic evaluation. Maveba 2021, 167-170. DOI: 10.36253/978-88-5518-449-6.